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EXAMINER	
OLSEN, KAJ K	

ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 02/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/029,659	PROHASKA ET AL.	
	Examiner	Art Unit	
	Kaj K. Olsen	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2005 and 25 November 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20,21 and 23-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20, 21, 23-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 20, 21 and 23-32 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 20, 21 and 23-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Claims 20 and 31 have been amended to replace "moisture" with --equilibration--. Although this obviates some of the examiner's previous issues concerning the claims (namely how could the polymer be without moisture during its entire existence), this doesn't obviate all the issues the examiner raised. In particular, applicant's claims state that these ionomers have been without equilibration "since inception". However, all the applicant has support for is that the ionomers have been without equilibration since being purchased. How does applicant know that the commercial producer of the membranes didn't equilibrate them prior to selling them in a

dry form? Applicant has never disclosed what du Pont did with these membranes prior to making them commercially available and applicant doesn't have support for stating that the membranes haven't been equilibrated since inception. From the specification, the applicant appears to treat the term "equilibrated" as being the exposure of the membrane to a liquid solution. See paragraphs 0003 and 00020. However, as the Encyclopedia of Polymer Science and Engineering and Aldrich appears to evidence that the Nafion 117 presumably could have already underwent a process that reads on the applicant's defined equilibration. In particular, the Encyclopedia teaches that Nafion is made in the sodium ion form, but that this can be converted to other forms by immersion in an electrolyte (see p. 399). Aldrich teaches that Nafion 117 (an ionomer utilized by the instant invention) is sold in its hydrogen ion (i.e. acidic) form. How did the Nafion get into the acidic or hydrogen ion form without some process that reads on the applicant's defined equilibration (i.e. soaking it in an acidic electrolyte)? This is further evidenced by Shen (USP 5,650,054), which teaches that the commercially available hydrogen form of Nafion is first converted back into the sodium form (col. 15, ll. 21-24) and reconverted to the hydrogen form by soaking in an acidic solution (col. 16, ll. 17-20). This would indicate that soaking the synthesized sodium form of Nafion in an acidic solution would have been an obvious manner of creating the commercially available hydrogen ion (i.e. acidic) form of Nafion. However, the claims as drafted would forbid such an equilibration.

6. The examiner posits that is it possible that (as an example) du Pont could have synthesized the Nafion not in the sodium form, but rather the hydrogen ion form (albeit unlikely considering that an OH donor (like NaOH) would presumably be necessary to convert SO_2 groups into SO_3^- (see fig. 2 of the Encyclopedia)). In such a hypothetical case, the Nafion sold

by du Pont would apparently read free of equilibration since inception assuming du Pont performed no further equilibrations. However, applicant still would not appear to be in a position to state that the ionomer is free of equilibration since its inception because applicant provided no disclosure to evidence that the ionomers were free of equilibration during their entire existence. Applicant appears to only have support for stating that the ionomers are free of equilibration during the construction of the sensor itself, not before they came into possession of the ionomers themselves.

7. Moreover, the examiner is confused by this continued emphasis on the fact that the ionomer must be non-equilibrated or not exposed to moisture not only during manufacturing (which the examiner appreciates), but also during its entire inception. It would appear to the examiner that the key aspect of the instant invention is the fact that the ionomer membrane should be dry *while the sensor is being constructed.* See the last sentence of paragraph 00019 where applicant states that the "use of wet Nafion® *in the manufacturing process*" (emphasis added) is what is being avoided. See also the first sentence of paragraph 00023, which similarly states that the use of wet Nafion *during the manufacturing* is what is being avoided. What difference does it make if the ionomer membrane was equilibrated at some point prior to the manufacturing of the sensor as long as the ionomer is dry during the manufacturing process. Shen already disclosed that the membrane can be converted back and forth between two different exchange states (see discussion above) and gave no suggestion that the Nafion somehow structurally suffered by these repeated ion exchanges.

Claim Rejections - 35 USC § 103

8. Claims 20, 21 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over EP 1 037 041 A2 in view of any one or more of Lawrance et al (USP 4,272,353) or Debe et al (USP 6,319,293) with or without the further teaching of Aldrich Chemical Catalog.

9. EP '041 discloses a method for making a sensor that comprises the steps of providing a substrate 21, placing at least one opening 22 in the substrate, placing an electrode (23, 24, 28) proximate to the at least one opening and contacting a ionomer membrane 25 to the substrate and electrode. See fig. 4 and paragraphs 0031 through 0033. With respect to the ionomer membrane being "dry", EP '041 never specifies whether the membrane is wet or dry during the hot pressing stage of sensor construction. However, numerous references teach that the membrane can be "dry" during electrochemical cell construction. Lawrance teaches that keeping the membrane dry during sensor construction allows the membrane to be roughened providing greater adhesion and catalytic activity for the sensor. See col. 11, l. 62 through col. 12, line 48. Debe also teaches that the membrane should be dried prior to construction of an electrode-membrane assembly. See col. 16, ll. 50-61 and col. 31, ll. 17-31. Although Debe teaches that the membrane could be soaked prior to this dried stage, Debe also teaches that this soaking can be dispensed with altogether is so desired. See col. 25, ll. 20-25. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of Lawrance and/or Debe and utilize a dry form of membrane during the contacting step of EP '041 because the use of a dry membrane obviates the prior art repeatedly recognized the use of the dry form of the membrane.

10. Moreover, Lawrance teaches that conventional hot-pressing (i.e. the technique utilized by EP '041) utilizes temperature of 182-188 °C (see col. 12, ll. 33-35), which greatly exceeds the boiling temperature of water. Hence this indicates that in order for one to hot-press a membrane to a substrate surface, one would have had to apply enough heat to dry the membrane first because thermodynamically the membrane could not get to those temperatures until the water was driven from the membrane anyway. In view of this, one possessing ordinary skill in the art would have recognized that a dry form of the membrane would have been preferable for hot-pressing because the hot-pressing stage would have occurred more quickly with less heat application for an already dried membrane over a wet membrane. Moreover, even if a "wet" membrane were utilized for the hot-pressing step, as discussed above the membrane would have been dried during that hot-pressing stage anyways and would still have met the claim requirement that the membrane be "dry" during the contacting step.

11. With respect to the membrane being non-equilibrated "since inception", the examiner questioned above whether the applicant had support for said limitation when the invention appears to be keeping the ionomer dry only during sensor manufacturing (which the combination of EP '041 and either Lawrance or Debe rendered obvious). Moreover, the examiner questioned how Nafion materials like Nafion 117 (utilized by the instant invention), which are commercially available in the acidic form, can be considered to not read on non-equilibrated since inception when equilibration (i.e. immersing in an acidic electrolyte) would be necessary for having the acidic form of these materials in the first place. Because of this, the examiner believes the disclosure only covers the use of non-equilibrated dry ionomers only during the sensor manufacturing process itself and doesn't cover the ionomers prior to the applicant coming into

possession of the ionomers. However, even if the examiner assumes that the applicant has appropriate support for stating that the membrane is dry and non-equilibrated "since inception" and the examiner assumes that the commercially available Nafion utilized by instant invention was in fact non-equilibrated since inception, it is noted that Debe teaches the use of Nafion 117 as the source of Nafion. See col. 25, ll. 20-43. Similarly, the Aldrich catalog teaches that Nafion 117 is a conventionally available form of Nafion that provides ready to use thin sheets. This is the same form of Nafion that is utilized by the instant invention (see paragraph 0009) and commercially available Nafion 117 would presumably meet the claimed requirement that the ionomer be free of equilibration since its inception as evidenced by the applicant's own disclosure. It would have been obvious to one of ordinary skill in the art at the time the invention was being made for EP '041 to utilize sheets of Nafion 117 as the ionomer because said sheets are readily available and have already been established as being suitable for electrochemical devices. If commercially available Nafion 117 is dry since its inception (as evidenced by the instant invention) and if it is obvious to keep the membrane dry during sensor construction (as set forth by the combination of EP '041 and either Lawrance or Debe), then this would meet the equilibration limitations even if applicant had support for these limitations.

12. With respect to aligning the electrode with a gas passage, see fig. 4.

13. EP '041 further discloses a counter electrode (4, 14, 24) and a reference electrode 28. See paragraph 0048 as an example. With respect to wetting the membrane, applicant does not appear to positively recite a step of wetting the membrane (however, see discussion below).

14. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over EP '041 in view of Lawrence or Debe (with or without Aldrich) as applied to claim 20 above and in further view of LaConti et al (USP 4,820,386).

15. The references set forth all the limitations of the claim and EP '041 further disclosed the presence of a layer (2 or 22) for slowing inputs of gas moving through the at least one opening. However, EP '041 did not explicitly disclose that said layer could be a polymer. LaConti teaches this layer can comprise polymers. See col. 3, ll. 62-65; col. 5, ll. 49-58 and col. 6, ll. 59-68. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of LaConti for the method of EP '041 and Lawrance or Debe because the substitution of one known diffusion material for another requires only routine skill in the art.

16. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over EP '041 and either Lawrence or Debe (with or without Aldrich) as applied to claim 20 above, and further in view of Shen et al (USP 5,650,054).

17. The references set forth all the limitations of the claims, but did not explicitly recite the presence of a reservoir. However, Shen discloses utilizing a reservoir to ensure that the membrane remains hydrated regardless of the humidity level of the air. See col. 7, ll. 50-61. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to add the reservoir of Shen to manufacturing of EP '041 in view of Lawrance or Debe in order to manufacture a sensor that provides consistent response regardless of humidity level of the measured gas.

18. Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over EP '041 in view of either Lawrance or Debe (with or without Aldrich) with evidence from, or in further view of, Beech et al (Carbon Monoxide Sensors, Electrochemistry at Loughborough, pp. 1-4, 1999).

19. These claims differ from claim 20 in specifying the presence of a hole in the dry ionomer membrane. However, this broadly defined "hole" would read on any pores that might by present in the ionomer membrane itself. Beech evidences that Nafion inherently has gas permeability and water diffusion properties. See p. 2. In order for Nafion to provide gas permeability and water diffusion, Nafion must possess some degree of porosity and this degree of porosity would read on the claimed "hole" giving the claim language its broadest reasonable interpretation.

20. Alternatively, even if all forms of Nafion are not gas permeable and water diffusible and Beech cannot be utilized to evidence that the particular Nafion of EP '041 was gas permeable and water diffusible, Beech is drawn to a gas sensor and teaches that gas permeability and water diffusion properties of the Nafion desired for its sensor. Presumably, these properties are desired because a hydrated Nafion has an improved sensor response (see discussion of Shen above) and the permeability would improve the sensitivity and response time of the sensor. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Beech for the method of EP '041 in view of Lawrance or Debe in order to improve the sensitivity, sensor response and response times for the sensor.

21. Claims 20, 21 and 24-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prohaska et al (USP 6,682,638) in view of either Lawrance or Debe with or without Aldrich.

22. The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

23. Prohaska is drawn to substantially the same sensor as set forth by the instant invention. In particular, Prohaska discloses placing hole 20 through both the substrate 10 and the ionomer membrane 5, placing a number of electrodes (3, 7, 8) in proximity to the hole, and teaches the presence of a reservoir 9 for hydrating the sensor. See fig. 1 and col. 2, l. 66 through col. 3, l. 42. Prohaska differs from the claims of the instant invention by specifying that the ionomer membrane is dry during the contacting step of manufacture. However, numerous references teach that the membrane can be "dry" during electrochemical cell construction. Lawrance teaches that keeping the membrane dry during sensor construction allows the membrane to be roughened providing greater adhesion and catalytic activity for the sensor. See col. 11, l. 62

through col. 12, line 48. Debe also teaches that the membrane should be dried prior to construction of an electrode-membrane assembly. See col. 16, ll. 50-61 and col. 31, ll. 17-31. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of any of Lawrance or Debe and utilize a dry form of membrane during the contacting step of Prohashka because the prior art repeatedly recognized the use of the dry form of the membrane.

24. Moreover, Prohaska suggests the use of "heat" for its contacting step (see col. 7, ll. 23-25). Lawrance teaches that hot-pressing (i.e. a conventional technique for attaching an ionomer membrane to other substrates via heat (see EP '041 and Lawrance)) utilizes temperature of 182-188 °C (see col. 12, ll. 33-35), which greatly exceeds the boiling temperature of water. Hence this indicates that in order for one to hot-press a membrane to a substrate surface, one would have had to apply enough heat to dry the membrane first because thermodynamically the membrane could not get to those temperatures until the water was driven from the membrane anyway. In view of this, one possessing ordinary skill in the art would have recognized that a dry form of the membrane would have been preferable for hot-pressing because the hot-pressing stage would have occurred more quickly with less heat application for an already dried membrane over a wet membrane.

25. With respect to the membrane being non-equilibrated "since inception", the examiner questioned above whether the applicant had support for said limitation when the invention appears to be keeping the ionomer dry only during sensor manufacturing (which the combination of Prohaska and either Lawrance or Debe rendered obvious). Moreover, the examiner questioned how Nafion materials like Nafion 117 (utilized by the instant invention), which are

commercially available in the acidic form, can be considered to not read on non-equilibrated since inception when equilibration (i.e. immersing in an acidic electrolyte) would be necessary for having the acidic form of these materials in the first place. Because of this, the examiner believes the disclosure only covers the use of non-equilibrated dry ionomers only during the sensor manufacturing process itself and doesn't cover the ionomers prior to the applicant coming into possession of the ionomers. However, even if the examiner assumes that the applicant has appropriate support for stating that the membrane is dry and non-equilibrated "since inception" and the examiner assumes that the commercially available Nafion utilized by instant invention was in fact non-equilibrated since inception, it is noted that Debe teaches the use of Nafion 117 as the source of Nafion. See col. 25, ll. 20-43. Similarly, the Aldrich catalog teaches that Nafion 117 is a conventionally available form of Nafion that provides ready to use thin sheets. This is the same form of Nafion that is utilized by the instant invention (see paragraph 0009) and commercially available Nafion 117 would presumably meet the claimed requirement that the ionomer be free of equilibration since its inception as evidenced by the applicant's own disclosure. It would have been obvious to one of ordinary skill in the art at the time the invention was being made for Prohaska to utilize sheets of Nafion 117 as the ionomer because said sheets are readily available and have already been established as being suitable for electrochemical devices. If commercially available Nafion 117 is dry since its inception (as evidenced by the instant invention) and if it is obvious to keep the membrane dry during sensor construction (as set forth by the combination of Prohaska and either Lawrance or Debe), then this would meet the equilibration limitations even if applicant had support for these limitations.

26. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prohaska in view of any one or more of Lawrance or Debe as applied to claim 20 above and in further view of LaConti.

27. This claim differs by setting forth the use of a polymer layer over the electrode. This claim is rendered obvious in view of LaConti for the same reasons given above.

Response to Arguments

28. Applicant's arguments with respect to claims appear to be largely verbatim of arguments made in previous responses. For example, applicant continues to argue about Shen, Fray and Surampudi when the examiner had dropped the use of those teachings in the previous office action. It is unclear why we are still arguing about dropped rejections. Shen is utilized as evidence for the 112 rejection above, but applicant's arguments concern Shen as teaching against the claims. The arguments concerning Lawrance and Debe appear to be verbatim the arguments previously made about these references. The examiner addressed these arguments in paragraphs 25 and 26 of the 8-30-2005 office action and will not reiterate them here.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaj Olsen whose telephone number is (571) 272-1344. The examiner can normally be reached on Monday through Thursday from 5:30 A.M. to 3:00 P.M. and on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen, can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AU 1753
February 2, 2006

KAJ K. OLSEN
PRIMARY EXAMINER